

Aspects of Exoplanet Science with a Microarcsecond Astrometry Mission

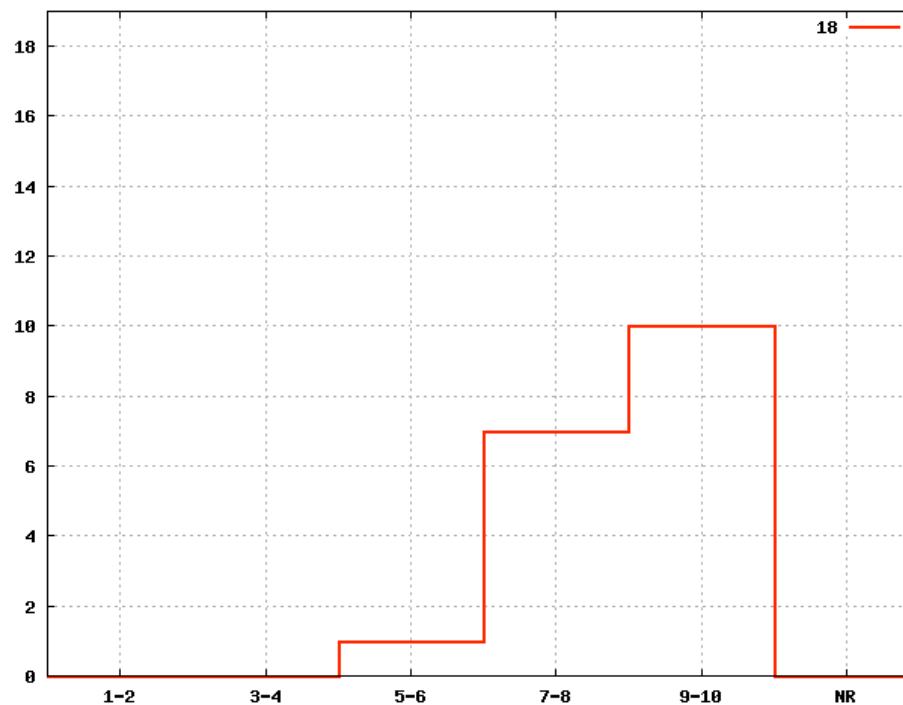
Ben Lane, on behalf of the
astrometry sub-committee
(CSDL)

ExoPTF & Survey Results

- The PTF recommended a micro-arcsecond level astrometry mission.
- The response from the astrometry community is (surprise!) highly enthusiastic.
- The Survey indicated a few near-consensus views:
 - Such a mission should proceed regardless of the status of GAIA.
 - Such a mission should seek low-mass planets over more numerous, (Neptune-) massive planets.
 - Such a mission should precede any direct imaging mission due to strong synergies
- Little consensus regarding the exact trade in the 1-2 M_{earth} regime

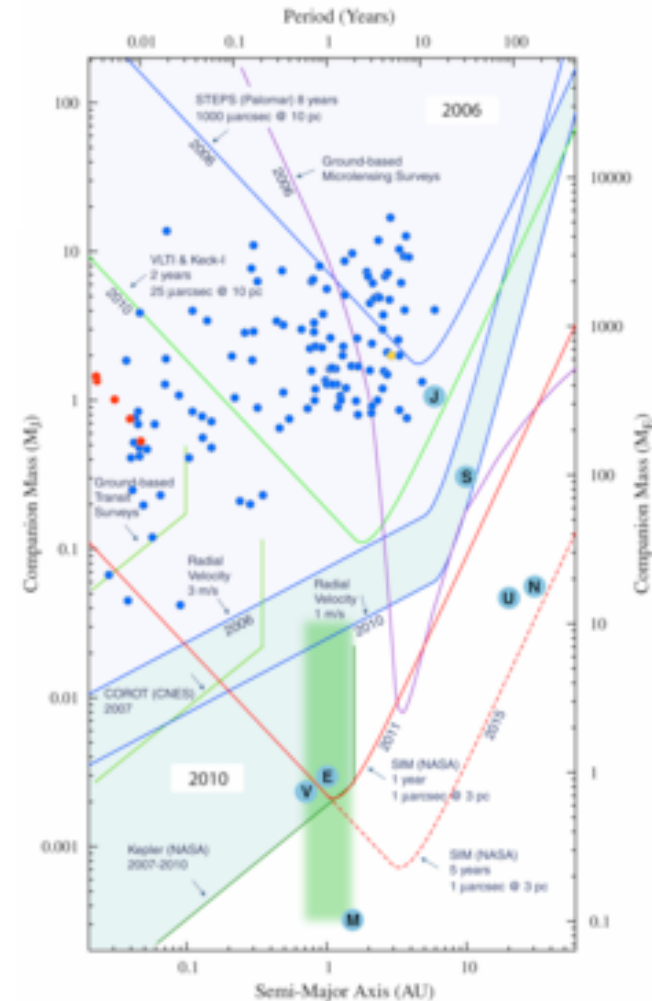
ExoPTF & Survey Results

- In general, do you agree with the Exoplanet Task Force Report and Recommendations? (1=strongly disagree, 10=strongly agree).



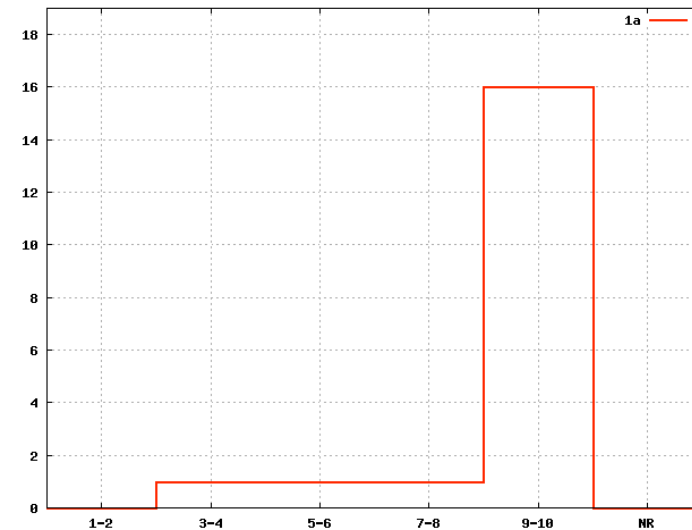
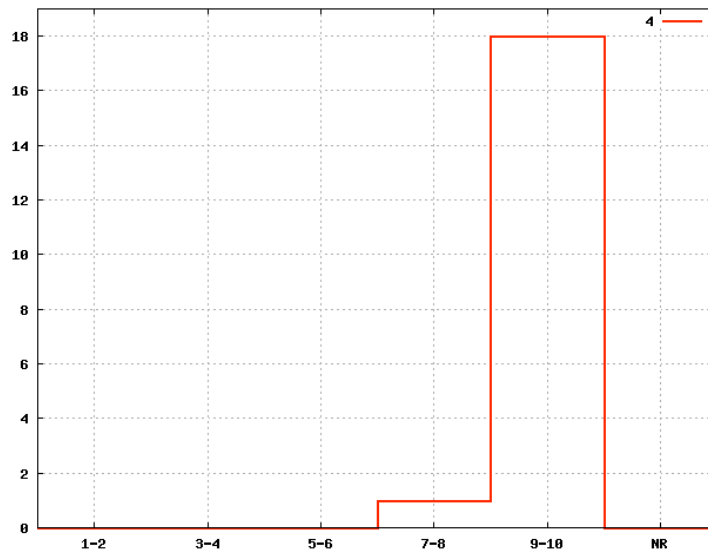
Exoplanets & Astrometry

- Astrometry is a good way to find Terrestrial-mass planets in HZ-type orbits around nearby stars.
 - Required precision is ~ 1 micro-arcsecond (or better).
- It can search all nearby systems and isn't restricted to fortunate alignments
- It provides a mass
- It yields full orbital parameters for targeted follow-up observations



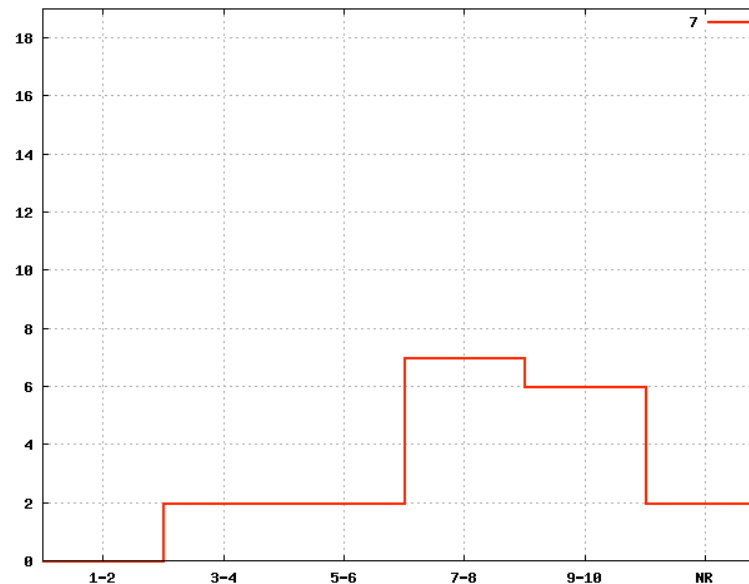
Finding Low-Mass Planets

- At what priority should future astrometric missions place finding low mass planets?
- At what priority should a space-based astrometric mission be placed: if the Gaia mission is conducted?



What is meant by “low-mass”?

- At what priority should sensitivity to 1 Mearth planets be pursued over surveying 4 times as many targets with 2 Mearth sensitivity?

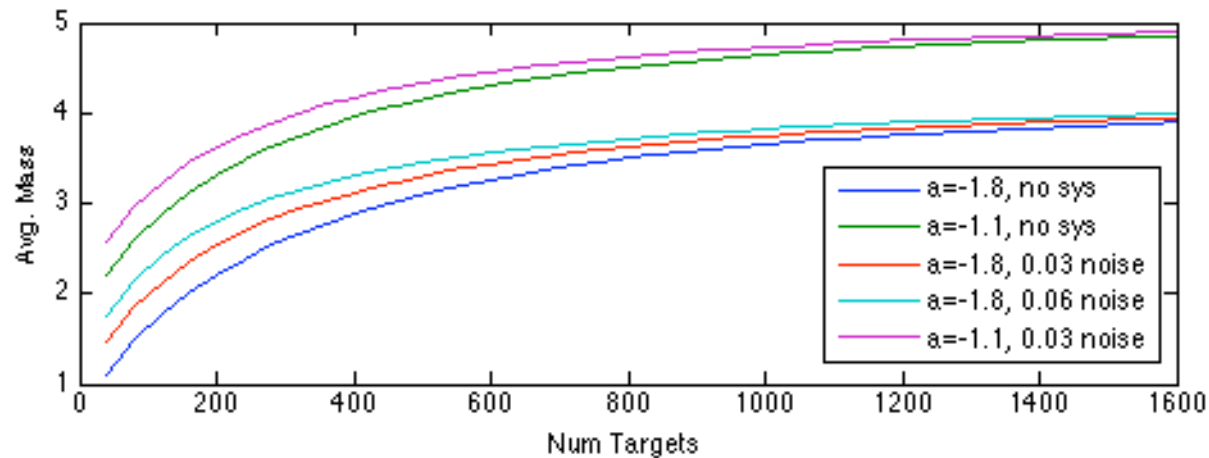
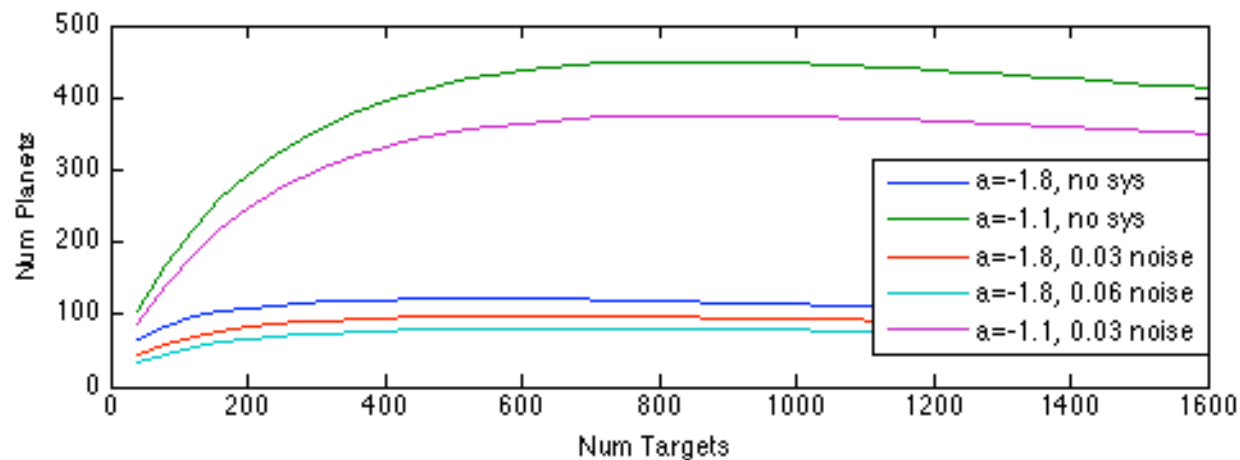


What is meant by “low-mass”?

(part 2)

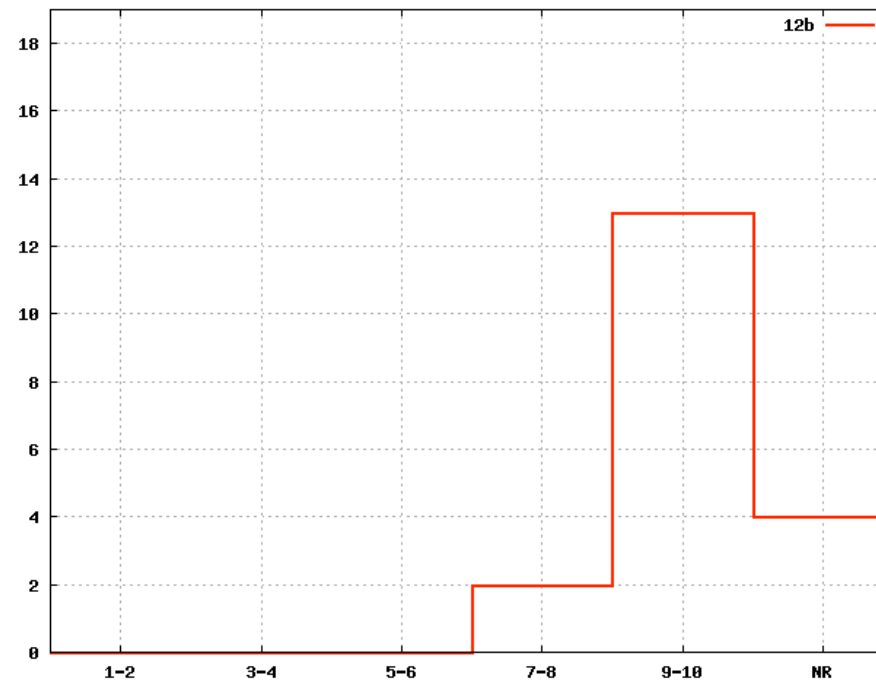
- Not a trivial question
 - Technical aspects of the instrument & observation, such as noise floors.
 - Astrophysical question: what is the distribution of low-mass planets?
 - Political question: is 1 Earth mass a magic number?

Trading Observations & Targets



Synergy with Direct Imaging

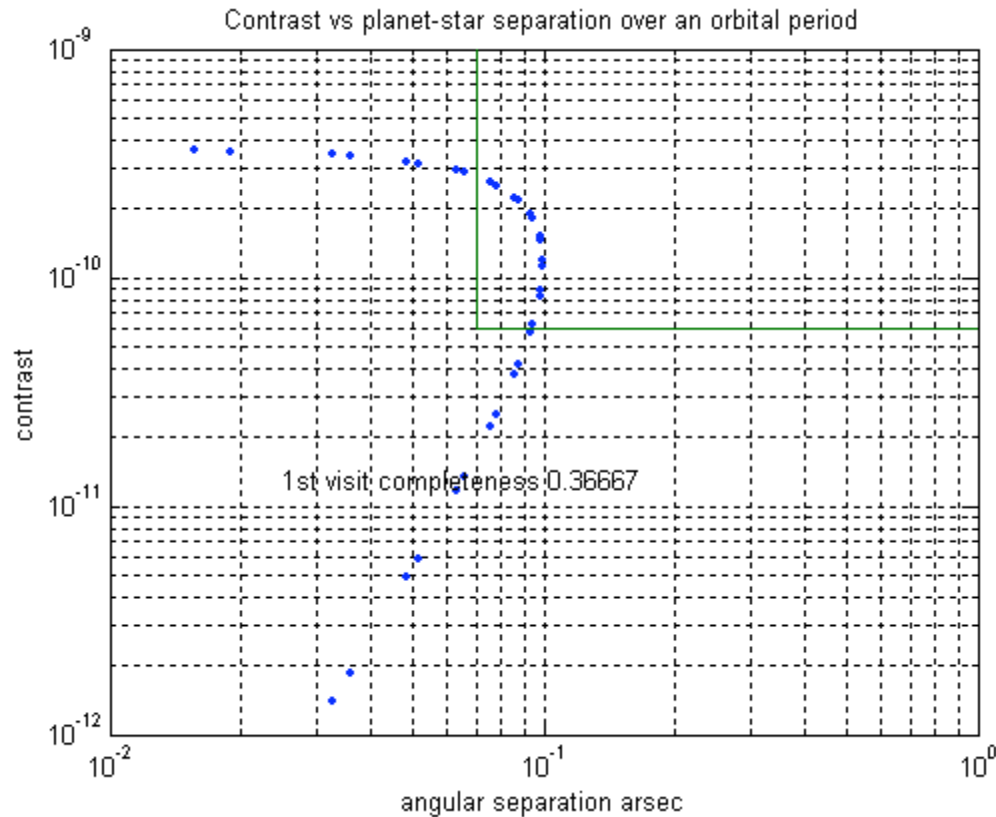
- If a direct detection mission is planned, is it important that an astrometric mission exist before-hand and have the role to determine specific targets for a direct detection mission?



Synergies

- The astrometry mission is a crucial precursor for any imaging mission
 - Finding which systems to image
 - Astrometry is more efficient for searches due to effect of Inner Working Angle of imager.
 - Determining the optimum time of observation
 - Determining the mass of the planet

Where to Look. When to Look



An Earth-Sun system at 10pc would have a maximum star planet separation of 100mas.

A **5m** coronagraph with a 70mas Inner working angle (800nm) would have only a 37% chance of detecting on the 1st visit.

If the planet had been detected astrometrically, a **3.5m** coronagraph could detect the planet on the first visit.